

Phytochemical Screening on Flavonoids and Flavonoid Contents of *Dyera polyphylla* (Miq.) Steenis Extracts

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Abstract: Flavonoids are polyphenolic compounds that perform various biological activities commonly found in plants. This study aims to explore the flavonoid profile and determine the total flavonoid content in the leaf, stem wood, and bark extracts of jelutung rawa (*Dyera polyphylla* Miq.). Extraction was performed using a multistage maceration technique with three solvents: *n*-hexane, ethyl acetate, and methanol. Flavonoid analysis was performed qualitatively and quantitatively. Qualitative analysis included phytochemical screening using specific reagents and HPLC (High Performance Liquid Chromatography), while total flavonoid content was determined by colorimetric method using 10% AlCl_3 reagent. The results showed that the HPLC chromatograms of leaves and stem wood extracts had the same pattern and were more complex than the stemwood bark extract. Phytochemical screening produced positive reactions in all extracts, indicating the presence of flavonoids. Ethyl acetate, methanol, and crude methanol leaves extracts showed the presence of flavonoids of flavone, chalcone, and flavanone groups. Thin-layer chromatography (TLC) tests also confirmed the presence of flavonoid compounds, with quercetin as the comparator compound. Quantitative analysis showed that ethyl acetate leaves extract had the highest total flavonoid content of 28.34 mg QE/g sample. Based on these results, it can be concluded that all extracts contain flavonoids and that leaf extracts show the most significant potential as the primary flavonoid source.

Keywords: Flavonoid, Jelutung Rawa, Total Flavonoid Content, Screening Phytochemical

INTRODUCTION

Indonesia has abundant natural resources that have the potential to be developed into essential ingredients for traditional medicine and natural chemical compounds in the tropics (Untoro et al., 2016). Kalimantan is one of the largest islands in Indonesia, with peatlands covering about 32% of the total peatland area, which plays an important role in the ecosystem and carbon storage (Saputro et al., 2021). However, peatlands often experience degradation due to deforestation and forest fires triggered by climate or weather (Ningsih et al., 2023). Despite these conditions, *D. polyphylla* can thrive in degraded peat areas. Its ability to adapt to peatlands can help improve soil quality, maintain moisture, and support hydrological balance, making *D. polyphylla* one of the most widely cultivated plants in peat areas (Wahyudi & Triyadi, 2022).

Jelutung trees can be divided into two types based on their habitat: jelutung darat (*Dyera costulata*) and jelutung rawa (*Dyera polyphylla*). Both species belong to the Apocynacea family and grow naturally in Sumatra and Kalimantan. *D. costulata* is known as a versatile plant because in addition to its helpful wood, its sap can also be used for various purposes such as raw materials for making chewing gum, cable insulators, cosmetics, and

traditional medicine to treat wounds and toothache ([Sofiyudin et al., 2012](#); [Aminah et al., 2016](#); [Wahyudi & Triyadi, 2022](#)). In addition, the bark and leaves of *D. costulata* are used in traditional medicine by healers in Southern Thailand to treat fever, inflammation, and pain ([Ngee et al., 2004](#)). Meanwhile, information on the utilization of *D. polyphylla* is still limited. *D. polyphylla* sap is reported to be more abundant than *D. costulata* ([Sofiyudin et al., 2012](#)). Due to the frequent degradation of peat swamp forests, *D. polyphylla* trees are rarely found in forests. *D. polyphylla* is categorized as critically endangered due to habitat destruction and overexploitation, so there are many studies on cultivating this plant ([Wahyudi & Triyadi, 2022](#); [Gaman et al., 2024](#)). However, in-depth exploration of the chemical content of *D. polyphylla* has not been widespread. Therefore, further research in chemistry is needed to support the preservation and optimal utilization of *D. polyphylla* plants.

Previous research on the *Dyera* genus, namely *D. costulata*, reported various bioactive compounds with significant biological activity. Some of these compounds include flavonoids such as quercetin-3-O- α -L-rhamnopyranosid and rhamnazine, which were isolated from the leaf extract of land jelutung ([Subhadhirasakul et al., 2003](#)). In addition, the extract from the bark of *D. costulata* contains benzoic acid and lupeol. These chemicals have been shown to have antioxidant, antidiabetic, and antibacterial activities (Arjinal et al., 2020). However, until now, no scientific reports have examined the chemical content and biological activities of *D. polyphylla*. The difference in habitat between terrestrial *D. costulata*, which grows on mineral soil, and *D. polyphylla*, which lives on peatland, could potentially affect the content of its secondary metabolites ([Ap et al., 2022](#)). Flavonoids are polyphenolic compounds widely distributed in various plants and their parts, such as roots, leaves, stems, skin, and seeds ([Yeti & Yuniarti, 2021](#); [Husna et al., 2022](#)). These compounds are often isolated because they have broad benefits, including as medicinal ingredients.

Based on these problems, this study aims to detect flavonoids from *D. polyphylla* plants through qualitative and quantitative analysis. Qualitative analysis was done using a phytochemical screening method through color changes with specific reagents and HPLC. The total flavonoid content was measured quantitatively using the colorimetric method with 10% AlCl_3 reagent. This research is expected to provide new insights into the flavonoid content of *D. polyphylla* plants and determine how much potential these plants have as a source of flavonoids.

RESEARCH METHODS

Materials and Tools

The materials used in this study include samples of leaves, stem wood, and stem bark of *D. polyphylla*. The solvents were methanol distillate solvent, n-hexane, ethyl acetate, and chloroform pro analysis (Merck KgaA, Germany). Other chemicals were concentrated HCl (Smart-Lab, Indonesia), H_2SO_4 (Smart-Lab, Indonesia), magnesium metal, and distilled water. In addition, thin aluminum layer chromatography plates coated with silica gel F254 (Merck KgaA, Germany) were used as a stationary phase in chromatographic analysis. For the determination of total flavonoid content, the materials used include ethanol 96% pro analysis (Merck KgaA, Germany), CH_3COONa (Merck KgaA, Germany), AlCl_3 (Merck KgaA, Germany), and pure quercetin.

The equipment used in this study included an oven, philip blender (600W), digital analytical balance (Advank Innotech), rotary vacuum evaporator (IKA RV 8), hot plate (IKA®), micropipette, whatman filter paper number 42, UV lamp 254 nm and 366 nm, drip

plate, and glassware (Pyrex®). Total flavonoid content was identified using UV-Vis spectrophotometer instrumentation (Shimadzu UV-1900I) and cuvette (Quartz).

Methods

Sample preparation

This study used parts of the leaves, stem, and bark samples of the *D. polyphylla* plant collected from Sungai Sepeti District, North Kayong Regency, West Kalimantan. Plant specimens were determined at the National Innovation Research Agency (BRIN), Cibinong, West Kalimantan. Plant parts were prepared by cleaning, cutting into small pieces, aerating, and pulverizing into powder.

Extraction

The maceration method extracted leaves, stem wood, and stem bark of *D. polyphylla*. 2/3 of the total weight of the simplisia powder was macerated using n-hexane solvent for multistage maceration. In contrast, the remaining 1/3 was macerated with methanol solvent for total maceration. The process was carried out for 3 x 24 hours through a solvent change every 24 hours. After that, the residue from the multistage maceration was again macerated using an ethyl acetate solvent, followed by methanol using a similar procedure. Each extract produced from each solvent stage was then evaporated with a rotary evaporator at 40°C until a thick extract was produced, which was then calculated as the percentage of yield through the comparison of the weight of the thick extract produced to the weight of the initial sample used before the extraction was carried out ([Putri et al., 2024](#)).

Phytochemical screening

Qualitative testing of leaf extracts, woody stems, and the bark of *D. polyphylla* is carried out using phytochemical screening methods with specific reagents and HPLC (high-performance liquid Chromatography). After the results are obtained, the extract is analyzed using an HPLC instrument with a reversible phase-type HPLC. The column used semi-preparative C-8 Phenomenex with methanol eluent of 90%, flow intensity of 1.5 mL/min, and operation of 25 minutes at 254 nm wavelength. The chromatogram results are analyzed based on the resulting complexity. Color testing using specific reagents to identify the presence of flavonoid compounds in the samples studied includes tests of shinoda, shibata, and concentrated H₂SO₄ ([Kurnianto et al., 2021](#); [Puspasari & Puspita, 2023](#)). Thin-layer chromatography (TLC) provides positive results that corroborate phytochemical screening results ([Yuda et al., 2017](#)). Three eluent systems were used in this study: n-heksane: ethyl acetate (7:3), n-heksane: ethyl acetate (1:9), and chloroform: methanol (9:1). After the TLC plate was eluted and sprayed with an AlCl₃ 10% reagent, the formed stains were observed, including stain color, stain count, and calculation of R_f values. Analysis of TLC uses quercetin as a comparative compound. Then, the value of R_f is calculated on each stain using the formula in equation 1.

$$R_f = \frac{\text{distance traveled by the sample}}{\text{distance traveled by the sample}} \quad (1)$$

Determination of total flavonoid content

Determining total flavonoid content refers to research conducted by [Sembiring et al. \(2018\)](#) with slight modifications. A quercetin standard was prepared by dissolving 10 mg of quercetin in 10 mL of 96% ethanol, resulting in a solution with a concentration of 1000 ppm. Dilution was performed by taking 1 mL of the solution and adding ethanol to a total volume

of 10 mL, which led to a standard solution with a concentration of 100 ppm. This solution created concentration variations of 20 ppm, 10 ppm, 5 ppm, 2.5 ppm, 1.25 ppm, and 0.625 ppm with ethanol as a blank. Each standard solution was taken as much as 1 mL, then 1 mL of 10% AlCl_3 , 1 mL of 1 M CH_3COONa , and 3 mL of ethanol were added, then incubated for 30 minutes. Maximum wavelength measurements were taken using a standard solution with a concentration of 20 ppm. To prepare the calibration curve, the absorbance values of the standard solution at concentrations of 20 ppm, 10 ppm, 5 ppm, 2.5 ppm, 1.25 ppm, and 0.625 ppm were measured at the maximum wavelength. The total flavonoid content was determined by dissolving 10 mg of extract in 10 mL of 96% ethanol. Then, 1 mL of solution was mixed with 1 mL of 10% AlCl_3 , 1 mL of 1 M CH_3COONa , and 3 mL of 96% ethanol. The mixture was allowed to stand for 30 minutes before the absorbance was measured through a UV-Vis spectrophotometer at a predetermined maximum wavelength. Absorbance measurement was done three times. The flavonoid concentration was calculated using the linear regression formula of the quercetin standard curve. The total flavonoid concentration was expressed as mg of quercetin equivalent (QE)/gram of plant extract, which was calculated using the formula in equation 2.

$$\text{Total Flavonoid Content} = \frac{V \times C}{W} \quad (2)$$

Description:

C = Concentration of extract obtained (mg/mL)

V = Volume of extract used (mL)

W = Weight of sample used (g)

RESULTS AND DISCUSSION

D. polyphylla samples consisting of leaves, stem wood, and stem bark were obtained from Sungai Sepeti Subdistrict, North Kayong Regency, West Kalimantan, and have been determined at the National Agency for Research and Innovation (BRIN) Cibinong, West Kalimantan. The sample determination results showed that the sample was *Dyera polyphylla* (Miq.) Steenis (B-3284/II.6.2/IR.01.02/9/2024). After determination, the samples were cleaned, aerated, and dried at 50°C using an oven. The samples were pulverized into simplisia powders with their respective weights, namely leaves 204.6 grams, stems 313 grams, and bark 68.8 grams, to increase the surface area in the extraction process ([Kusnadi & Devi, 2017](#)). The extraction process uses a multistage maceration technique. This technique was chosen because of the simplicity of the procedure and because it does not require heating to maintain the stability of the bioactive components contained in the sample ([Nurhasnawati et al., 2017](#)). The macerate obtained was then evaporated using a rotary evaporator at 40°C, and then the yield value was calculated to see the extraction efficiency based on the solvent used.

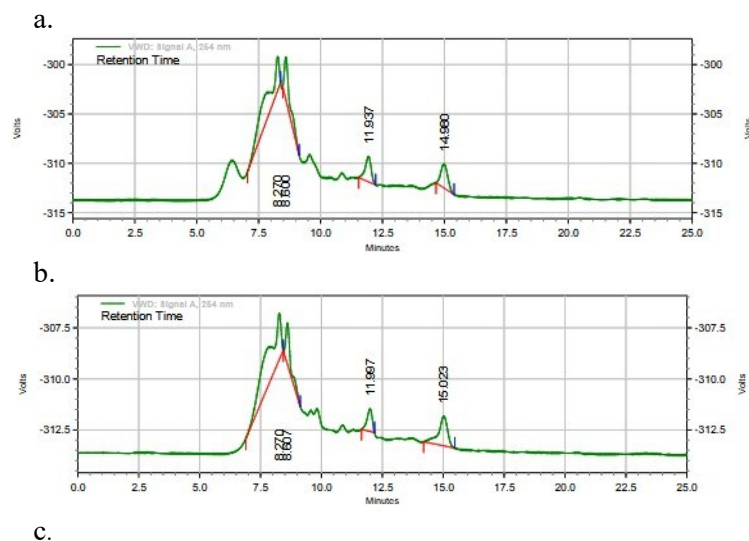
The highest yield from the total maceration method was obtained from the leaves at 15.1%, followed by the stem wood at 13.4%, and the stem bark at 10.6% (Table 1). The use of methanol as a solvent in total maceration effectively dissolves both polar and nonpolar compounds because methanol's small molecular structure can penetrate all plant tissues to extract active compounds, making it highly efficient in drawing out secondary metabolites present in the sample ([Aiyuba et al., 2023](#)). In the results of yield from the statified maceration of the leaves and bark of *D. polyphylla*, the highest yield was found in the methanol extract, with results of 13.27% and 17.00%, respectively. The lowest yield for the leaves occurred in

the n-hexane extract (3.2%), while the bark had its lowest yield in the ethyl acetate extract (0.9%). This indicates that more polar compounds were extracted from these parts.

Table 1. Yield of *D. polyphylla* leaves, stem wood, and stem bark extracts

Extraction Method	Sample	Sample Weight (g)	Extract Weight (g)	Yield (%)
Stratified Maceration	n-Hexane	Leaves	136.4	3.2
		Stem wood	208.6	10.7
		Stem bark	45.0	2.2
	Ethyl Acetate	Leaves	136.4	4.9
		Stem wood	208.6	10.9
		Stem bark	45.0	0.9
	Methanol	Leaves	136.4	13.3
		Stem wood	208.6	5.7
		Stem bark	45.0	17.0
Total Maceration	Methanol	Leaves	68.2	15.1
		Stem wood	104.3	13.4
		Stem bark	20.9	10.6

In contrast to the leaves and bark, the highest yields in the n-hexane and ethyl acetate extracts were 10.7% and 10.9%, respectively. This suggests that semipolar and nonpolar components in *D. polyphylla* stem wood are more dominant. The results align with the principle that solvents can penetrate cells and dissolve compounds based on the concept of "like dissolves like" (Noviyanty & Anggriani Salingkat, 2019). In multistage extraction, each solvent extracts specific compounds according to its polarity, while in total extraction, all compounds soluble in the solvent will be extracted (Hati et al., 2018).



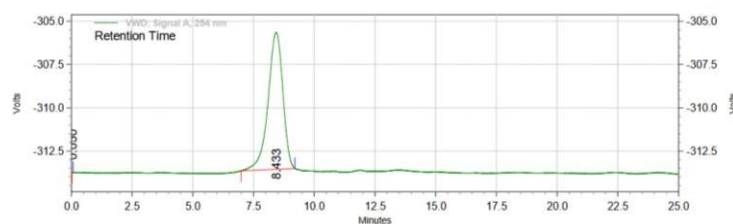


Figure 1. HPLC chromatogram profile of leaves (a), stem wood (b), stem bark (c) extracts

Phytochemical screening is a preliminary stage in natural material research that identifies the content of secondary metabolite compounds and provides an initial description of the composition of the compounds to be studied ([Vifta & Advistasari, 2018](#)). The chemical content profile of the total methanol extract in all parts of the *D. polyphylla* plant was analyzed using reversed-phase HPLC chromatography (RP-HPLC). The detector will detect each eluted compound through RP-HPLC analysis and record it as a chromatogram. The number of peaks appearing on the chromatogram reflects the number of components or the complexity of the sample, while the peak area represents the concentration of each component ([Zainal et al., 2019](#)). This technique separates compounds based on polarity, where more polar compounds will elute first than semipolar or non-polar compounds ([Aulia et al., 2016](#)). The results of reversed-phase HPLC analysis on methanol extracts of leaves and stem produced similar and more complex separation patterns compared to the chromatogram of stem bark extracts, which showed a less complex profile (Figure 1). This indicates that the content of compounds in the leaves and stem wood of *D. polyphylla* are similar. Based on the chromatogram pattern obtained, the similarity of retention time between several peaks indicates the possibility that the detected compounds are the same ([Lestari & Prasasti, 2018](#)).

Phytochemical tests with specific reagents are carried out to determine the content of flavonoid compounds in each extract that can change the color of the extract. In the Shinoda test (Mg-HCl reduction), the ethyl acetate leaves extract and methanol extract, as well as the total extract, showed positive results with a change in color in the extract to orange, which indicates the presence of flavonoids of the flavone type ([Kurnianto et al., 2021](#)) (Table 2). The addition of magnesium (Mg) and hydrochloric acid (HCl) aims to produce flavillium salts that have a red or orange color through a reduction process in the benzopyrone core, which is a component of the flavonoid structure ([Qomaliyah et al., 2023](#)). In the Shibata test, positive results were seen in methanol leaf extracts and total methanol extracts characterized by orange color changes, indicating the presence of flavone compounds. Meanwhile, in the concentrated H_2SO_4 test, all extracts showed positive results in all plant parts characterized by orange color changes in all stem wood and stem bark extracts, methanol leaf extracts, and total methanol extracts, indicating the presence of flavanone compounds. While in n-hexane and ethyl acetate leaf extracts, there is a bluish-red change indicating the presence of calkon-type flavonoids ([Puspasari & Puspita, 2023](#)).

Phytochemical testing on the leaf, stem wood, and steam bark of *D. polyphylla* extracts showed the diversity of flavonoid groups contained therein. Previous research by [Subhadirasakul et al. \(2003\)](#) related to the content of chemical compounds in jelutong plants reported that the leaves of *D. costulata* that were successfully isolated contained flavonoid compounds, namely rhamnazin and quersetin-3-O-a-L-rhamnopyranoside, which belong to the flavonol sub-class.

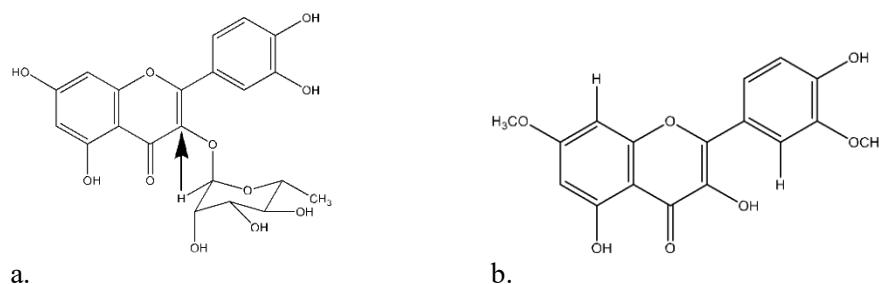


Figure 2. Structure of compounds (a) rhamnazine, (b) quercetin-3-O-a-L-rhamnopyranoside

The TLC test was conducted to confirm the results of the phytochemical screening with specific reagents and determine the chromatographic profile of the extracts. Silica gel 254 plates were used as the stationary phase, with three eluent systems: n-hexane: ethyl acetate (7:3), n-hexane: ethyl acetate (1:9), and chloroform: methanol (9:1). The extracts were photographed on plates and eluted in a chamber saturated with filter paper to ensure the homogeneity of the eluent. The elution process separates components based on their solubility in the mobile phase (Yuda et al., 2017; Mustaqimah, 2023). The stains were observed under UV 254 nm and 366 nm and then confirmed with a 10% AlCl₃ stain intensifier (Hasan et al., 2023).

Table 2. Phytochemical test results with specific reagents of *D. polyphylla* extract

Sample		Testing Methods		
		Shinoda test	Shibata test	H ₂ SO ₄ test
		Orange (flavone), pink (flavonol), dark red (2,3 dihydroflavonol), magenta (flavanone)	Red (flavonol), orange (flavone)	Yellow, bluish-red (chalcone), orange (flavanone)
Leaves	n-Hexane	-	-	(+) chalcone
	Ethyl Acetate	(+) flavone	-	(+) chalcone
	Methanol	(+) flavone	(+) flavone	(+) flavanone
	Crude	(+) flavone	(+) flavone	(+) flavanone
Stem wood	n-Hexane	-	-	(+) flavanone
	Ethyl Acetate	-	-	(+) flavanone
	Methanol	-	-	(+) flavanone
	Crude	-	-	(+) flavanone
Steam bark	n-Hexane	-	-	(+) flavanone
	Ethyl Acetate	-	-	(+) flavanone
	Methanol	-	-	(+) flavanone
	Crude	-	-	(+) flavanone

Notes: (+) flavonoids were detected; (-) no flavonoids were detected.

The results of the TLC test showed that the n-hexane: ethyl acetate (7:3) eluent was the best eluent for separating the components in the *D. polyphylla* plant with many separated stains and no tail (Astuti et al., 2023) (Figure 3). Observation of the TLC stains under UV light at 254 nm produces a plate that fluoresces with dark stains. Meanwhile, stains that are not visually detected at 254 nm can fluoresce under UV 366 nm, making the stain visible while the TLC plate appears dark. Visualizing stains under UV 366 nm produces a fluorescence color that varies from bluish to reddish. One of the stains at UV 366 nm with R_f values of 0.13 and 0.15 is close to the R_f of quercetin (0.14), indicating the presence of quercetin-like compounds. The interpretation of flavonoid groups can be done based on the

color of the spots that appear. When observed under UV light at 366 nm, flavonol and chalcone compounds show fluorescence properties. In contrast, flavonol glycoside compounds, anthocyanins, and flavones will absorb light to appear as dark spots with a fluorescent background. Each compound has different color characteristics; namely, flavone and flavonol glycosides display yellow fluorescence, flavonols look pale yellow, catechins show a pale blue color, anthocyanins are gray-blue, and calkon and auron display a red color (Yuda et al., 2017; Hasan et al., 2023). According to Wagner and Bladt (1996), flavonoid compounds can fluoresce and display yellow, green, and blue colors. High Rf values in leaf extracts indicate chlorophyll compounds due to their nonpolar nature.

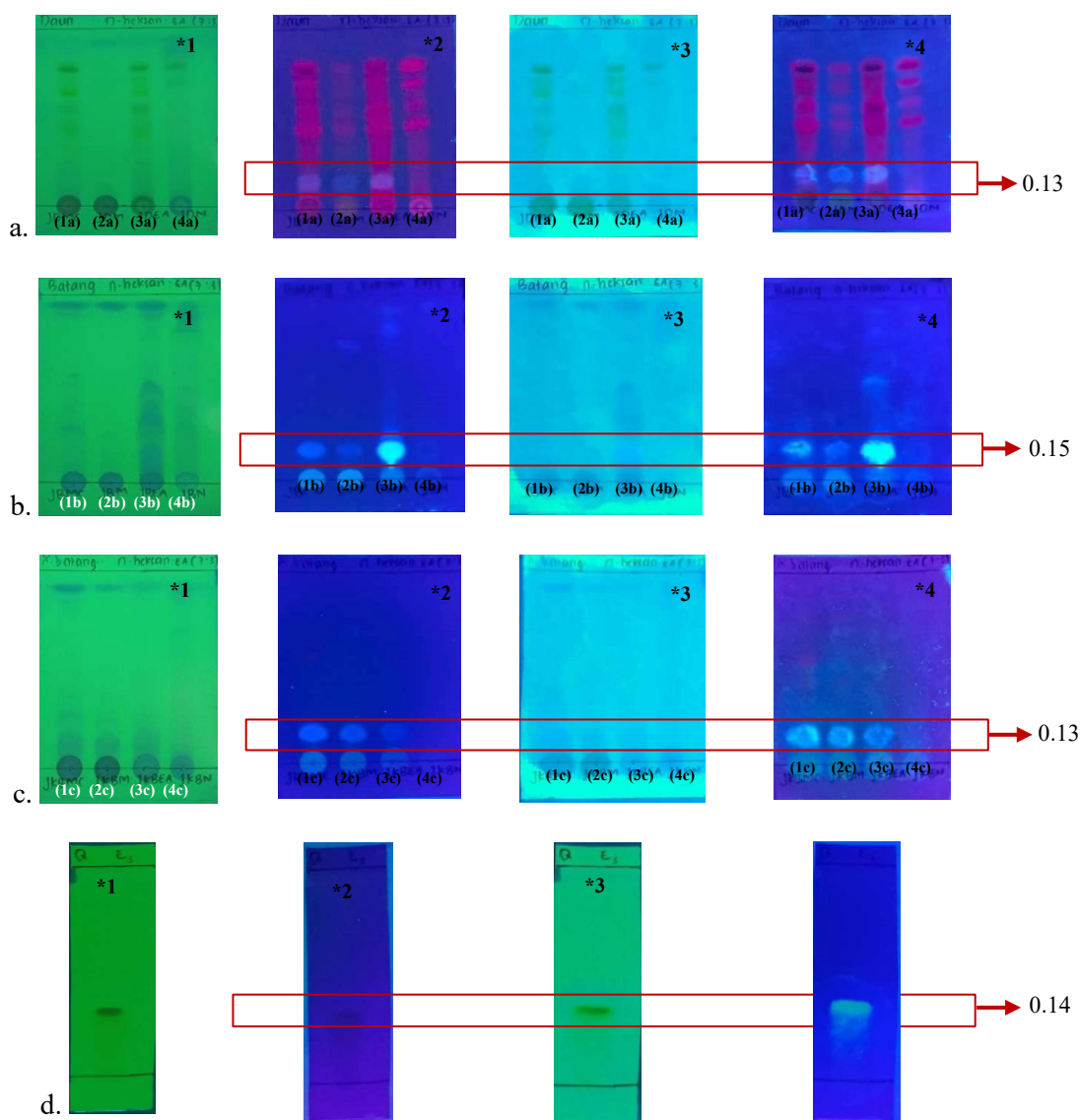


Figure 3. The TLC chromatogram of crude extract (1); methanol extract (2); ethyl acetate extract (3); n-hexane extract (4) from leaves (a), stem wood (b), stem bark (c), quercetin (d) using eluent system n-hexane: ethyl acetate (7:3) and viewed at UV 254 nm (*1); UV 366 nm (*2); UV 254 nm + AlCl_3 (*3); UV 366 + AlCl_3 (*4)

The presence of chlorophyll is indicated by green stains on the TLC plate when observed with visible light and produces red luminescence when observed under UV light 366 nm (Santosa & Haresmita, 2015). The addition of 10% AlCl_3 does not change the color of the stain significantly but increases the fluorescence intensity. The addition of AlCl_3 will cause the reaction of AlCl_3 to flavones and flavonols through the formation of color complexes on the ketone group C4 and -OH C3 or C5 (Candra et al., 2021). The R_f values obtained from leaf, stem wood, and stem bark extracts are close to the R_f value of quercetin, indicating the similarity of flavonoid structures in these plant parts. Stains with R_f values of 0.13 and 0.15 are considered catechin-type flavonoids based on the blue color under UV 366 nm, characteristic of flavonoid compounds (Hasan et al., 2023). The TLC results shows that detected flavonoid compounds is polar because the eluent used is non polar and the R_f value generated is relatively small.

The total flavonoid content in the *D. polyphylla* extract was measured using a colorimetric method with a UV-Vis spectrophotometer. AlCl_3 was added to form stable complexes with ketone groups at the C-4 position and hydroxyl groups at the C-3 or C-5 position of flavone and flavonol compounds. Adding sodium acetate keeps the wavelength in the visible area, and 30 minutes of incubation ensures the reaction occurs ideally before measurement to produce optimal color intensity (Bachtiar et al., 2023). Quercetin was used as a standard with a concentration series of 20 ppm, 10 ppm, 5 ppm, 2.5 ppm, 1.25 ppm, and 0.625 ppm to determine flavonoid levels through the standard curve equation. Measurement at a concentration of 20 ppm resulted in a wavelength of quercetin at 430.7 nm. Absorbance measurements at a series of concentrations of quercetin that have been prepared are used to make a standard curve of quercetin. These measurements obtained a linear regression equation $y = 0.0163x - 0.014$ with a relation coefficient (R^2) of 0.993 (Figure 4). The value of the relation coefficient is close to 1, indicating a strong linear correlation between absorbance and concentration of the standard solution.

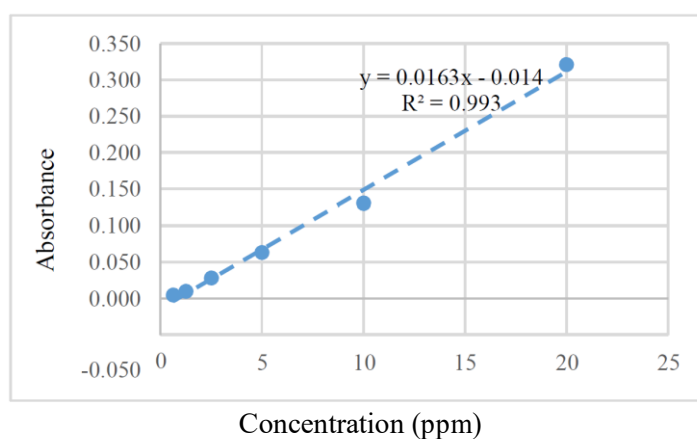


Figure 4. Quercetin Standard Curve

The quercetin standard curve equation was used to determine the total flavonoid content of the samples. The absorbance of each plant extract sample was measured at a maximum wavelength of 430.7 nm. The leaf extract yielded the highest flavonoid content with the total maceration method, measuring 16.38 mg QE/g. The multistage maceration

method showed that the ethyl acetate leaf extract had the most flavonoids, with 28.34 mg QE/g. The methanol leaf extract came in second, with 15.39 mg QE/g. Meanwhile, the n-hexane leaf extract produced the lowest level of 3.00 mg QE/g. This indicates that the leaves of *D. polyphylla* can potentially be the primary source of flavonoids in *D. polyphylla* plants. In addition, this result indicates that the type of flavonoids contained in the extract of *D. polyphylla* tends to be more polar to semipolar. Ethyl acetate and methanol, as polar solvents, are more effective in extracting flavonoids from this plant. Flavonoids with polar hydroxyl groups are more soluble in polar solvents such as ethyl acetate and methanol, resulting in higher flavonoid levels. Meanwhile, n-hexane is less effective because flavonoids do not dissolve easily in nonpolar solvents. This finding highlights the importance of selecting appropriate solvents for the extraction process to maximize flavonoid yield. Furthermore, the polarity of the solvent not only affects the quantity of flavonoids extracted but may also influence their bioactivity and potential health benefits.

Table 4. Total flavonoid content of *D. polyphylla* extracts

Sample		TFC (mg QE/g sample)
n-Hexane	Leaves	3.01±0.00
	Steam	5.81±0.29
	Bark	3.09±0.12
Ethyl Acetate	Leaves	28.34±0.00
	Steam	6.34±0.23
	Bark	5.85±0.28
Methanol	Leaves	15.39±0.00
	Steam	9.08±0.12
	Bark	7.99±0.04
Methanol Crude	Leaves	16.38±0.00
	Steam	4.33±0.09
	Bark	6.01±0.16

Note: TFC= Total Flavonoid Content; values are presented as mean ± standar deviation, n=3

CONCLUSIONS

Based on qualitative analysis with the phytochemical screening method, the study showed that the *D. polyphylla* extract contained diverse flavonoid groups, including flavones, flavanones, and chalcones. Quantitative analysis showed that the highest total flavonoid content was found in ethyl acetate leaf extract, which amounted to 28.34 mg QE/g sample, followed by methanol leaf extract with 15.39 mg QE/g sample. These results indicate that flavonoid compounds contained in *D. polyphylla* extracts are more polar to semipolar. This indicates that the extract from *D. polyphylla* leaves has potential as a source of flavonoids, so further exploration of the flavonoid content of *D. polyphylla* can be done on the leaves.

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